

The E.C.A.L.O. System

ECALO is an acronym for Energy Conserving Automatic Light Output. It is the most flexible fluorescent lighting system available and offers users major energy savings while still providing aesthetically pleasing lighting.

The ECALO System, which uses standard fluorescent lamps and ballasts, can directly save 50% or more of the electrical energy traditionally used for the same fluorescent lamp fixture. In use, ECALO does not create the undesirable cosmetic or other defects which often result from the de-lamping or under-lighting approaches commonly used to effect energy conservation.

With ECALO, the light output of new or existing in-place fluorescent lamps can be adjusted to different levels of illumination with related energy savings. Once the light level at a particular fixture's sensor is selected, ECALO automatically adjusts the input power to maintain the selected light level. This ability eliminates the need for designed over-lighting to compensate for lamp aging effects. Furthermore, if daylight is present, each fixture will proportionally adjust the power input/light output level downward.

The economic benefits that are derived from the ECALO System come from four sources

Elimination of designed over-lighting

Until ECALO, the light output of a fluorescent lamp system, using standard ballasts, declined with use. There are two main reasons for this:

- Dust collects on the lamps and/or the diffuser and absorbs the light output.
- The efficacy of the lamp's phosphor is gradually reduced. This occurs because material emitted from the cathode collects on the phosphor coating inside the tube. Also some of the more energetic ultraviolet radiation in the electric arc causes some phosphor molecules to be destroyed.

For these reasons, fluorescent lighting systems traditionally have been designed to produce excess light when new, in order to insure an adequate level of light at the end of a lamp's life cycle. Such over-lighting requires a correspondingly higher average energy consumption. Figure I illustrates the decline in light output with lamp age when the lamp is operated with a standard ballast.

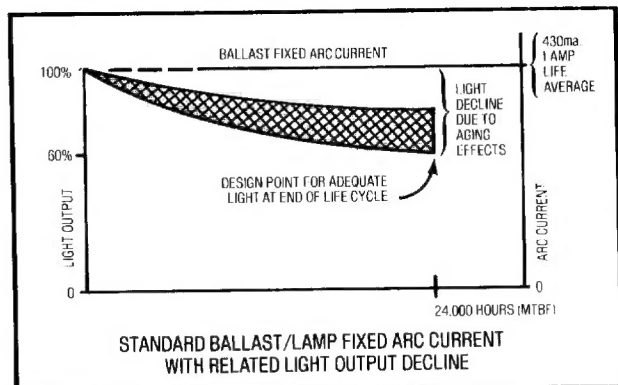
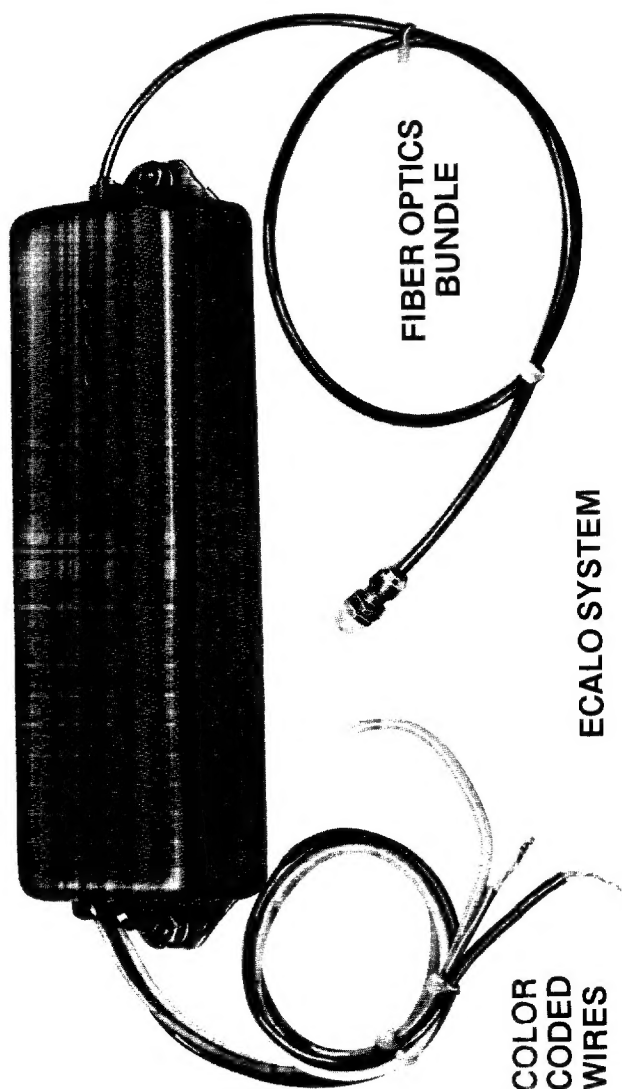


FIGURE 1

With ECALO added to a standard ballast it is no longer necessary to have excess starting light to accommodate maintenance and aging factors. With the ECALO System, the electric arc is started at a lower level which results in correspondingly less lamp wear occurring. In time, as the light would otherwise begin to decline due to phosphor decay, the ECALO advances the arc current to hold the light at the design level. Thus, the average electrical power consumed over the lamp's life span is reduced. Figure II illustrates the expanding arc concept employed by ECALO. By not having to overlight, the initial energy savings will be about 30% and gradually lessen as the arc is increased.



To find out more...

The ECALO System is manufactured under one or more of United States Patents Nos. 3,422,310 Reissue No. 28,044; 3,659,147; 3,781,598; 3,891,695; and/or patents pending, and is available in models for (2) and (4) lamp fixtures using F40 rapid start lamps with either 120 or 277 VAC ballast primaries. For further information on the ECALO System, call or write:

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Solar control

Daylight will also control the fluorescent system and save ECALO users lighting dollars. The automatic and proportional control of the input power, as a function of the light level falling on a particular fixture's sensor means that as daylight enters a room, the fluorescent lighting will automatically adjust downward with related energy savings. The average power savings resulting from solar control can be as great as 33% in offices with high window to floor area ratios. Figure III shows how the fluorescent lighting in a typical room varies at different fixtures relative to the natural light present.

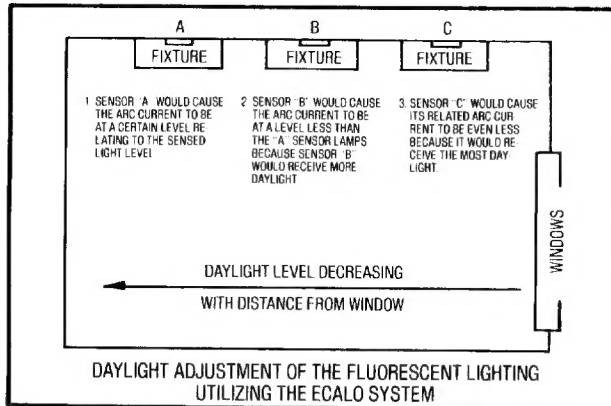


FIGURE 3

Reduced cooling energy

Almost all fluorescent electrical usage is converted not into light but into heat via the pathways shown in Figure IV. This heat, sometimes utilized in the winter months, must be disposed of in the summer months. When the air conditioning equipment is operating, each watt of electrical energy consumed for lighting also causes an additional expenditure of about one-half watt of air conditioning power. So, substantial cooling energy can be saved by reducing electrical lighting loads.

Virtually all U.S. electric utility companies have higher energy charges during summer months. During these months, the daylight period is longer and the sun is brightest, allowing the ECALO System to minimize the use of electrical

energy for lighting and air conditioning. Aside from the dollar savings, an ECALO user is also contributing to the lessening of summer time brown-out risk.

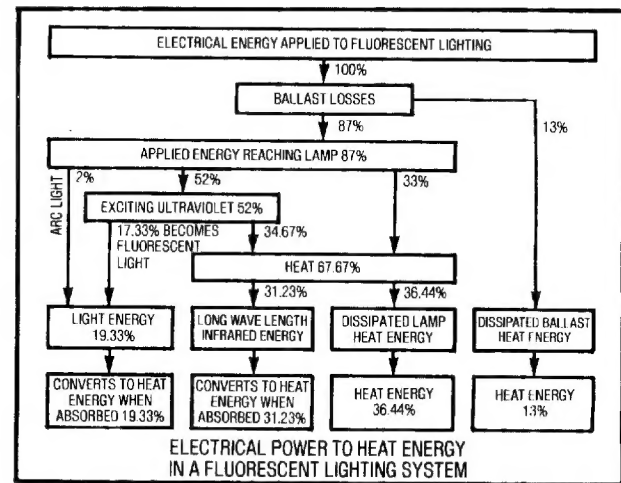


FIGURE 4

Summary of ECALO's economic benefits

Together, the various features offered by ECALO can greatly reduce the total energy consumption of a fluorescent lighting system as follows:

With a lighting power budget equal to 100%

(a) By eliminating the need for designed over-lighting for lamp aging factors 15% of the power budget can be saved - 15%

85% remaining

(b) By maximizing the use of zone or work-function lighting, up to 50% of the remaining power can be saved (.5 × .85) - 42%

43% remaining

(c) In areas with a high window to floor area ratio, daylight control can save up to 33% of the remaining power (.33 × .42) - 14%

The Power Budget is Reduced 72% to 28%

The above 72% calculation would only apply where all of the above mentioned features could be fully utilized. Such is rarely the case. For example, a building's interior would receive little benefit from the solar control feature. Likewise some work function areas like drafting rooms still require a high lighting level. Therefore the combined average power savings in most buildings would fall in a range lower than the 72%. If, for example, the direct lighting power savings were 50%, the indirect savings in air conditioning power would equal half that amount again during the air conditioning months. If such were five months, an overall annual savings of 60% would be a reasonable expectation. In buildings dependent on the lighting system as a heat source in the colder months, the ECALO system can be re-adjusted upward to permit over-lighting for heat purposes.

Installation, Reliability and Warranty

Another important feature of ECALO is that its retrofit installation is easier than installing a replacement ballast. The physical system is packaged in a standard 40 watt ballast can. It mechanically mounts in the excess space of a fixture's ballast housing. The wiring consists of three color-coded wires in a (2) lamp fixture and four wires in a (4) lamp fixture that must be attached with wire nuts to the existing AC and ballast (s) wiring. The physical unit also has a 1/8" diameter bundle of fiber optics which must be run outside of the fixture in order to sense the surrounding light level.

From a reliability and safety standpoint there are no known failure modes in the low voltage solid state control circuits employed in the ECALO system. Furthermore, the system does not produce any RF or electrical noise components that would limit its application.

With regard to the warranty, because the average power input is reduced, ballast losses are lower with a corresponding reduction in hot spot temperature. This feature extends the life of a regular ballast in a manner similar to the new energy conserving higher efficiency ballasts being advertised by ballast manufacturers. For these reasons the two year ECALO unit warranty is also extended to cover any recognized standard ballast properly installed with an ECALO system.

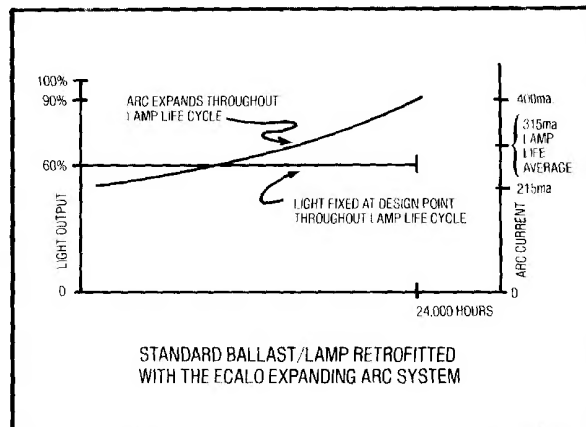


FIGURE 2

Referencing the light output

ECALO lets you set the light level with related power savings. Another energy conservation benefit of the ECALO System is derived from the system's ability to reference the light output at each fluorescent fixture. This feature offers a new level of flexibility in zone or work function lighting. Unlike de-lamping, with its cosmetic and safety defects, and the need to place a worker under a remaining lamps-on-fixture, ECALO permits light level adjustment and re-adjustment to fit lighting needs at any time. For example, hall lighting can be referenced at about 15 foot candles, other areas, such as lobbies or conference rooms, at 40 foot candles. Office work areas can be referenced uniformly or to varying levels depending on the requirement. For example, a (2) F40 lamp, standard ballast fixture has a consumption of 94 watts. The same fixture, fitted with the ECALO System, will consume substantially less power depending on the desired light level.

Gen 7

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and we find 0/003 to
the truth.

To: Energy Officers

Sub: Payback Calculation

If a four (4) lamp E.C.A.L.O.
unit costs \$^{15.00}20.00, and the
fluorescent fixture used
was on ³⁰⁰⁰4000 hours per
year (national average)...

1) Fixture Watts (normal)

$$188 \times 4000 = \overset{564}{752} \text{ KWh}$$

2) ⁵⁶⁴752 KWh x 5¢/KWh =

$$\overset{33.94}{\$37.60} \text{ /year Power Cost}$$

3) If 50% of the power
were saved, the E.C.A.L.O.
unit would pay for itself
in approximately ~~13~~
months.

2/1/85
6 M05

Introducing the most
flexible fluorescent
lamp lighting system
available today...

The
E.C.A.L.O.
System

Energy Conserving
Automatic Light
Output

Controlled Energy Corporation
AN AFFILIATE OF
CONTROLLED ENVIRONMENT SYSTEMS, INC.

CONTROLLED ENVIRONMENT SYSTEMS INC.

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